

vergent lines of development, but give merely the degree of progress in two particular lines of specialization arbitrarily selected. The figures, however, are interesting to one who knows these species by sight — even surprising — especially in the Libellulinae, where they seem to support no one's theory of the interrelationships of the genera.

PHRYGANIDIA CALIFORNICA, *PACKARD*.

BY BEVERLY LETCHER.

Had the general excellence of the account of the life history of this moth as set forth by Vernon L. Kellogg and F. J. Jack (Proceedings of the California Academy of Sciences, second series, Vol. V, 1895, page 562) been maintained throughout their article, there would hardly have been occasion for the present but with them critical observation seems to have ceased with the pupal stage. Other differences are slight but as they are of some interest, may be noted.

To afford a ready comparison of the head measurements, they have been tabulated, those of Kellogg and Jack appearing in the first column and those of the writer in the third. Little value can be attached to the several durations of stages in the fourth column as they were made on larvæ subject to the artificial surroundings of the study: they are from observations of the summer brood while those of Messrs. Kellogg and Jack were made on wintering larvæ.

Stage.	Kellogg and Jack.		Letcher.	
	Mm.	Days.	Mm.	Days.
Egg		10		10
1st	.68	14	.53, .67	8
“ supplementary			.73	8
2d	1.14	13	1.15	6, 8
3d	1.45	17	1.32, 1.47	7
4th	1.88	25	1.82	8
5th	2.21	21	2.20	5
6th	2.57	12	2.31	9
Pupa		10		9

A practical agreement is to be noted for the 1st, 2d, 3d, 4th and 5th stages. My observations show a stage supplemental to the 1st and

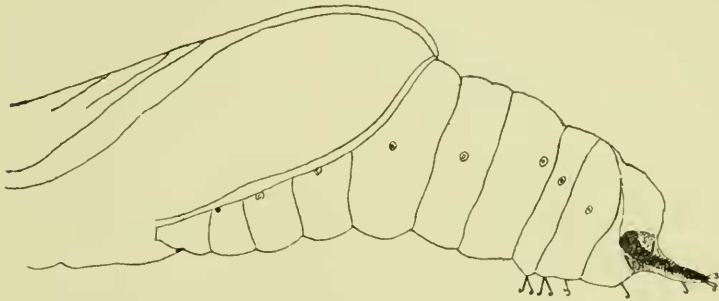
what was at the time of disturbing, a measurement of one larva in the first stage of .53 mm. and of one in the third of 1.32 mm. The 2.31 of the sixth stage as against 2.57 mm. was also suspicious, but as it had been carefully taken and was the average of a number but slightly varying, there can be no question as to its correctness. The calculated series for the second set of observations would be (ratio .80) .74, .94, 1.16, 1.48, 1.85 and 2.31 which contains most of the observed stages: and for the first .54, .68, .85, 1.06, 1.32, 1.65, 2.06 and 2.57. In neither of these does the observed fifth stage (2.20) find a place: but all of the others, including the abnormal measurements, appear in one or the other of the series.

Markings.—The development of the markings also shows a close correspondence, although through the absence of the divided first stage their derivation was not as clear to the first investigators.

The .53 mm. stage shows no markings whatever: the first stage (.68 mm.) a faint, claret-colored transverse shade on the 1st, 3d, 5th, 7th, 8th and 9th abdominal segments extending across the dorsum to tubercle iii on each side. In the supplementary stage the subdorsal line (sometimes interrupted) appears widening on each segment to reach tubercle iii and on the 2d thoracic, to surround tubercle i. The transverse dorsal shades have now on abdominal segments 1, 3, 5, 8 and 9 become distinct and broad and extend ventrally on segments 1, 7 and 8 (7, however, has become clear dorsally) to beyond the as yet undeveloped tubercle vi. In the second stage, the dorsal line appears indicated by spots, always on the thoracic segments and interruptedly on the abdominal. Traces of the infraspicular line are also apparent. In the third stage, the infraspicular line is more clearly marked and a supraspicular line is developed by the restriction and breaking up of the transverse bands. The fourth stage shows all lines well marked—dorsal, addorsal, subdorsal, supraspicular, infraspicular and subventral. In later stages, there is a gradual broadening and fusion of the lines so that in some individuals the markings appear yellowish green on a dark ground instead of the reverse. The greenish-yellow ground color appears to exist in the fat body: the claret-colored markings are cuticular.

Wart Formation.—Is that of the typical noctuina pattern, large in first stage, later much reduced; setæ are simple. Tubercle vi wanting through the .73 mm. stage. Secondary setæ appear in the second stage, one above and one below tubercle iii and caudad to it.

Pupa. — In addition to the hooks of the cremaster (by which alone the article above cited says it is attached) the pupa has a series proceeding from the dorsum, one pair on 9th abdominal, two on 8th and one on 7th. The attachment is therefore quite rigid and is at first



sight peculiar in that the pupa faces out, its dorsum being applied to the supporting surface. No recorded observation is familiar to me, but such pupæ of the micros as have come to my notice face out and among the macros, pupæ of *Ctenucha ochroscapus* assume the same position; to what extent it may be characteristic of the Heterocera I cannot say.

The wing-cases are well developed and full and with a shortening dorsally of the 7th abdominal segment cause the dorsal surface to be more or less concave. The 5th and 6th segments are free. The 9th segment disappears ventrally and the 10th dorsally, the large 10th sternite assisting materially in producing the concave dorsum. The wart formation and setæ appear in the pupa in a very much reduced state.

There is a great deal of variability in the extent of the pupal markings, but where they do not occur the pupal case after emergence of the wings is transparent and readily lends itself to a study of the interior. In tracing the extent and location of the mouth and head parts it was noted that the clypeus showed internally the structure of the cocoon breaker which occurs in other forms, although there is no suggestion externally of its existence.